


FORM PTO-1390 (REV 10-94)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		DOCKET #: 3245-779PUS <b>09/719933</b>
<b>TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371</b>				
				U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
INTERNATIONAL APPLICATION NO <b>PCT/DE99/01586</b>		INTERNATIONAL FILING DATE <b>May 26, 1999</b>		PRIORITY DATE CLAIMED <b>June 18, 1998</b>
TITLE OF INVENTION <b>Roadside Control Device for a Toll Apparatus Installed in a Motor Vehicle</b>				
APPLICANT(S) FOR DO/EO/US <b>Andreas WIDL; Ronald BARKER</b>				
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <p>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371</p> <p>3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</p> <p>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p>a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input type="checkbox"/> has been transmitted by the International Bureau.</p> <p>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)</p> <p>6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</p> <p><input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input type="checkbox"/> have been transmitted by the International Bureau.</p> <p>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p>d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An EXECUTED oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> <p><b>Items 11. to 16. Below concern other document(s) or information included:</b></p> <p>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</p> <p>14. <input type="checkbox"/> A substitute specification.</p> <p>15. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>16. <input checked="" type="checkbox"/> Other items or information (<i>specify</i>): PCT Publication Sheet, Int'l Preliminary Examination Report, Int'l Search Report, PCT Request</p>				

U.S. APPLICATION NO. (if known, see 37 CFR 1.57) <b>097719933</b>		INTERNATIONAL APPLICATION NO. <b>PCT/DE99/01586</b>		ATTORNEY'S DOCKET NUMBER <b>3245-779PUS</b>	
17.[x]The following fees are submitted:					
<b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b> Search Report has been prepared by the EPO or JPO ..... <b>\$860.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482)..... <b>\$690.00</b> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... <b>\$710.00</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$1000.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)..... <b>\$100.00</b>					
ENTER APPROPRIATE BASIC FEE AMOUNT =				<b>\$860</b>	
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	20 - 20 = 0		x <b>\$18.00</b>	\$	
Independent Claims	2 - 3 =	0	x <b>\$80.00</b>	\$	
Multiple dependent claim(s) (if applicable)			+ <b>\$270.00</b>	\$	
TOTAL OF ABOVE CALCULATIONS =				<b>\$860</b>	
Reduction of 1/2 for filing by small entity, if applicable.				\$	
SUBTOTAL =				<b>\$860</b>	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				<b>\$860</b>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by the appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property				\$	
TOTAL FEES ENCLOSED				<b>\$860</b>	
Amount to be refunded:				\$	
charged:				\$	
a. [x]One check in the amount of \$ <u>860</u> to cover the above fees is/are enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. <u>03-2412</u> in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. [x]The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>03-2412</u> . A duplicate copy of this sheet is enclosed.					
<b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b>					
SEND ALL CORRESPONDENCE TO: <u>Klaus P. Stoffel</u> Cohen, Pontani, Lieberman & Pavane 551 Fifth Avenue, Suite 1210 New York, New York 10176			 <u>Klaus P. Stoffel</u> Registration Number: 31,668 Tel: (212) 687-2770		

09/719933

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Attorney Docket # 3245-779PUS

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re National Phase PCT Application of

Andreas WIDL et al.

International Appln. No.: PCT/DE99/01586

International Filing Date: May 26, 1999

For: Roadside Control Device for a Toll Apparatus  
Installed in a Motor Vehicle

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents

Washington, D.C. 20231

**BOX PCT**

S I R:

Prior to the issuance of a first Office Action and simultaneously with the filing of the present application, please amend said application as follows:

In the Specification:

Page 1, delete line 3;

after line 3, insert --BACKGROUND OF THE INVENTION,

Field of the Invention--;

after line 9, insert --Discussion of the Prior Art--;

please amend the paragraph starting at line 10 as follows:

From EP 0 691 013 B1, the content of disclosure of which is included in the present application by reference, an electronic deduction system is known by means of which utilization charges can be collected from vehicles which move through a predetermined geographic zone or a chargeable road distance (utilization charges = toll). The known system provides that in each motor vehicle, a toll apparatus is installed which has a receiver for the signals of a navigation satellite system such as, e.g., GPS (Global Positioning System) or Glosnar and is provided with an electronic memory in which the chargeable road distances and the geographic zones (in the text which follows, only chargeable roads or road distances are mentioned, to simplify matters) and the respectively associated utilization tariffs are listed. Using the signals of the navigation satellite system, the toll apparatus has access to the current geographic position of the vehicle at any time and recognizes from the stored data concerning the chargeable road distances whether the motor vehicle is on a chargeable road distance or not and can automatically determine the toll amounts which may be due in this manner. To ensure completely anonymous deduction of the toll amounts, the known system provides for the use of debit cards (e.g. chip card) on which the respectively due toll amounts are deducted by the toll apparatus.

Page 2,            please amend the paragraph starting at line 16 as follows:

From EP 0 701 722 B1, a toll apparatus is known which exhibits for this purpose a device for self monitoring for unauthorized manipulations at the individual components of the toll apparatus and an error memory for recording diagnostic data in the case of an [unauthorization] unauthorized manipulation. If an unauthorized manipulation occurs, the

toll apparatus can send out a signal indicating the improper operation of the apparatus via a corresponding signal device.

Page 3, after line 11, insert --SUMMARY OF THE INVENTION--;  
please amend the paragraphs starting at line 12 as follows:

It is, therefore, the object of the present invention to [specify] provide a roadside control device for checking the correct operation of a toll apparatus for satellite-supported electronic toll deduction which, on the one hand, ensures a high success rate during the checks to be performed but, on the other hand, requires the least possible expenditure for the apparatus technology and the operation of the control device.

[According to the invention, this object is achieved by a control device having the features specified in Claim 1. This control device can be advantageously developed further by means of the features of the dependent subclaims. An advantageous use of the control device according to the invention is specified in Claim 17.]

Page 4, please amend the paragraph starting at line 1 as follows:

According to the invention, the control device has at least the following facilities:

- a) a communication device for the wireless exchange of information between the control device and the toll apparatus in the passing vehicle,
- b) a classification device for allocating the passing vehicle to a predetermined vehicle class,

c) a trigger device for the accurately timed activation of the devices of the control device,

d) an evaluating device for a plausibility check of the data supplied by the communication device and the classification device from the and on [the] passing vehicle (or its toll apparatus, respectively), and

e) a recording device for recording the license plate of the passing vehicle in the case of an unsuccessful exchange of information of the communication device with the toll device of the passing vehicle or in the case of a negative result of the plausibility check of the evaluating device.

Page 5, please amend the paragraph starting at line 1 as follows:

In particular, such information contains details on the vehicle class used as a basis for the charge deduction and on the proper booking of the toll amounts, for instance on a debit card or alternatively via the correct transmission of the toll amounts to a charge deduction center. The communication device is preferably constructed as a dedicated short-range communication (DSRC) device for the frequency range from 2.4 to 5.8 GHz. It can also be appropriate to use a terminal for a cellular network (CN) or a data radio network as the communication device. Such a terminal is of advantage especially if it is suitable for digital mobile radio and corresponds, e.g., to the GSM standard. A terminal for the Mobitex system can also be advantageously used. In principle, it is also possible to use a communication device in which the information is transmitted via infrared or ultrasonic signals. However, optical transmission methods are less preferred due to their sensitivity to physical obstructions on the

transmission path. It is also recommended to conduct the dialog between the control device and the toll apparatus of the respective motor vehicle in encrypted form. For this purpose, corresponding encryption and decryption components must be provided in the control device and in the motor vehicle or, respectively, the toll apparatus of the motor vehicle. This distinctly increases the security against manipulation. In the vehicle, the keys necessary for encryption can be stored, for example, in a chip card or a fixed memory of the toll apparatus or of the communication device used in the motor vehicle. A particularly effective protection against manipulation can also be guaranteed if, apart from the current charge and chip card information, satellite, position and/or other apparatus information is interrogated and transmitted to the control device. If the roadside control device is equipped with a receiver for the signals of the navigation satellite system used, in a corresponding manner to the vehicle-mounted toll apparatus, the satellite signals currently received at the vehicle can be compared, for example, with the satellite signals currently received by the roadside control device. In this manner, confusions with other vehicles which are passing the roadside control device at the same time or very closely in time, and data manipulation can be virtually eliminated. This correspondingly also applies if the passing vehicle provides direct information on its current position at the time of the dialog.

Page 12, after line 7, insert --BRIEF DESCRIPTION OF THE DRAWINGS--;

please amend the paragraph starting at line 12 as follows:

Figure 1 shows a block diagram of a control device according to the invention;  
and

after line 15, insert --DETAILED DESCRIPTION OF THE  
PREFERRED EMBODIMENTS--;

please amend the paragraph starting at line 16 as follows:

The control device 1 shown in the form of function blocks in Figure 1 exhibits a communication device 2 which, for example, is constructed as a dedicated short-range communication device for a frequency in the region of 5.8 GHz. The control device 1 also comprises a classification device 3, the sensor system of which contains an electronic image sensor (e.g. in the form of an electronic camera). The control device 1 also has a trigger device 4 which is connected to the communication device 2 and the classification device 3 for signals. In addition, an evaluating device 5 and a recording device 7 [is] are connected for signals to the trigger device 4. The evaluating device 5 consists, e.g., of an electronic computer which performs a plausibility check with regard to the vehicle class of the vehicle currently being checked and passing the control device 1. For this purpose, this computer compares relevant information which is obtained from the checked vehicle or, respectively, from its toll apparatus via the communication device 2, with the corresponding information on the passing vehicle which has been determined by the control device itself in order to be able to specify the relevant vehicle class. If the evaluating device 5 finds that the vehicle class used in the toll apparatus in the vehicle is different from the vehicle class determined by the control device 1 itself, a signal is generated which is representative of the state that the vehicle currently passing is not performing a correct deduction of the road usage charges. A corresponding signal is then output via the trigger [devices] device 4 to the recording device 7 in order to make a recording which identifies the vehicle affected. This recording device 7 is



constructed, for example, as an electronic camera. At the same time, this can advantageously also be used as sensor system for the classification device 3.

Page 15, after line 18, insert the following:

Thus, while there have been shown and described and pointed out fundamental novel features of the present invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the present invention. For example, it is expressly intended that all combinations of those elements and/or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Substitutions of elements from one described embodiment to another are also fully intended and contemplated. It is also to be understood that the drawings are not necessarily drawn to scale but that they are merely conceptual in nature. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

In the Claims:

Please cancel claims 1-17 and add the following new claims:

18. A roadside control device for checking correct operation of a toll apparatus which is installed in a motor vehicle passing the control device and exhibiting an identifying license plate, the toll apparatus performing a satellite-supported electronic toll deduction, the control device comprising:

a) communication means for wirelessly exchanging information between the control device and the toll apparatus in the passing vehicle;

b) classification means for allocating the passing vehicle to a predetermined vehicle class;

c) evaluating means for carrying out a plausibility check of data supplied by the communication means and the classification means from and about the passing vehicle;

d) recording means for recording the license plate of the passing vehicle in case of an unsuccessful exchange of information of the communication means with the toll apparatus of the passing vehicle or in case of a negative result of the plausibility check of the evaluating means; and

e) trigger means for accurately timed activation of the communication means, the classification means, the evaluating means, and the recording means.

19. a control device as defined in claim 18, wherein the communication means includes a dedicated short-range communication (DSRC) device.

20. A control device as defined in claim 19, wherein the communication device is a radio device for a frequency range from 2.4 to 5.8 GHz.

21. A control device as defined in claim 18, wherein the communication means is a terminal for one of a cellular network (CN) and a data radio network.

22. A control device as defined in claim 18, wherein the communication means is operative to conduct a dialog with the motor vehicle in encrypted form.

23. A control device as defined in claim 18, wherein the classification means includes a sensor system which operates in accordance with one of an acoustic principle and an optical measuring principle.

24. A control device as defined in claim 23, wherein the sensor system of the classification means includes an electronic image sensor.

25. A control device as defined in claim 24, wherein the classification means operates in accordance with an optical correlation principle

26. A control device as defined in claim 18, wherein the trigger means includes an image sensor followed by image processing.

27. A control device as defined in claim 18, wherein the trigger means includes a radar sensor.

28. A control device as defined in claim 18, wherein the trigger means includes a laser sensor.

29. A control device as defined in claim 18, wherein the evaluating means is operative to compare the vehicle class transmitted by the toll apparatus of the motor vehicle via the communication means with the vehicle class determined by the classification means.

30. A control device as defined in claim 18, wherein the recording means includes an electronic camera.

31. A control device as defined in claim 30, wherein the classification means includes a sensor system including an electronic camera, the electronic camera of the recording device being physically identical to the electronic camera of the sensor system of the classification means.

32. A control device as defined in claim 18, and further comprising a receiver for the satellite navigation system used by the toll apparatus, the evaluating means being operative

to compare data determined by itself with data of the satellite navigation system interrogated from the toll apparatus, which data can be conducted to the evaluating means via the communication means.

33. A control device as defined in claim 18, and further comprising a radio device via which a recording of the license plate of the motor vehicle can be transmitted to a control center in case of improper operation of the toll apparatus found by the evaluating means.

34. A control device as defined in claim 33, and further comprising data compression means for transmitting data to the control center in compressed form.

35. A control device as defined in claim 18, wherein the control device is mountable on one of a mast and a bridge construction which extends over a road on which the motor vehicle is driving.

36. A control device as defined in claim 18, wherein the control device is arrangeable in a vehicle parked next to a road on which the motor vehicle is driving.

37. A method for detecting correctness of operation of a satellite-supported electronic toll apparatus in a vehicle and for securing evidence in case of improper operation of the toll apparatus, comprising the steps of:

wirelessly exchanging information between a control device and the toll apparatus in the passing vehicle via communication means;

allocating the passing vehicle to a predetermined vehicle class via classification means;

carrying out a plausibility check in evaluating means of data supplied by the communication means and the classification means from and about the passing vehicle;

recording the license plate of the passing vehicle in case of an unsuccessful exchange of information of the communication means with the toll apparatus of the passing vehicle or in case of a negative result of the plausibility check of the evaluating means; and

activating the communication means, the classification means, the evaluation means and the recording step in an accurately timed fashion.

In the Abstract:

[The invention relates to a] A roadside control device [(1)] for checking the correct operation of a toll apparatus [(11)] which is installed in a motor vehicle [(10)] passing the control device [(1)] and exhibiting an identifying license plate [(6), the] The toll apparatus [(11) performing] performs a satellite-supported electronic toll deduction and being equipped with the following facilities:

- a) a communication device [(2)],
- b) a classification device [(3)],
- c) a trigger device [(4)],
- d) an evaluating device [(5)], and
- e) a recording device [(7)].

[Publish with Figure 2.]

**REMARKS**

The present amendment is submitted prior to the issuance of a first Office Acton and simultaneously with the filing of the present application.

With this amendment applicants have amended the specification, cancelled claims 1 to 17 and added new claims 18 to 37, all in an effort to place the application in better condition for examination.

Favorable action on the present application is respectfully requested.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,

COHEN, PONTANI, LIEBERMAN & PAVANE

By: 

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18 December 2000



Page 1, starting at line 10:

From EP 0 691 013 B1, the content of disclosure of which is included in the present application by reference, an electronic deduction system is known by means of which utilization charges can be collected from vehicles which move through a predetermined geographic zone or a chargeable road distance (utilization charges = toll). The known system provides that in each motor vehicle, a toll apparatus is installed which has a receiver for the signals of a navigation satellite system such as, e.g., GPS (Global Positioning System) or Glosnar and is provided with an electronic memory in which the chargeable road distances and the geographic zones (in the text which follows, only chargeable roads or road distances are mentioned, to simplify matters) and the respectively associated utilization tariffs are listed. Using the signals of the navigation satellite system, the toll apparatus has access to the current geographic position of the vehicle at any time and recognizes from the stored data concerning the chargeable road distances whether the motor vehicle is on a chargeable road distance or not and can automatically determine the toll amounts which may be due in this manner. To ensure completely anonymous deduction of the toll amounts, the known system provides for the use of debit cards (e.g. chip card) on which the respectively due toll amounts are deducted by the toll apparatus.

Page 2, starting at line 16:

From EP 0 701 722 B1, a toll apparatus is known which exhibits for this purpose a device for self monitoring for unauthorized manipulations at the individual components of the toll apparatus and an error memory for recording diagnostic data in the case of an unauthorized manipulation. If an unauthorized manipulation occurs, the toll apparatus can

send out a signal indicating the improper operation of the apparatus via a corresponding signal device.

Page 3, starting at line 12:

It is, therefore, the object of the present invention to provide a roadside control device for checking the correct operation of a toll apparatus for satellite-supported electronic toll deduction which, on the one hand, ensures a high success rate during the checks to be performed but, on the other hand, requires the least possible expenditure for the apparatus technology and the operation of the control device.

Page 4, starting at line 1:

According to the invention, the control device has at least the following facilities:

- a) a communication device for the wireless exchange of information between the control device and the toll apparatus in the passing vehicle,
- b) a classification device for allocating the passing vehicle to a predetermined vehicle class,
- c) a trigger device for the accurately timed activation of the devices of the control device,
- d) an evaluating device for a plausibility check of the data supplied by the communication device and the classification device from and on the passing vehicle (or its toll apparatus, respectively), and
- e) a recording device for recording the license plate of the passing vehicle in the case of an unsuccessful exchange of information of the communication device with the toll

device of the passing vehicle or in the case of a negative result of the plausibility check of the evaluating device.

Page 5, starting at line 1:

In particular, such information contains details on the vehicle class used as a basis for the charge deduction and on the proper booking of the toll amounts, for instance on a debit card or alternatively via the correct transmission of the toll amounts to a charge deduction center. The communication device is preferably constructed as a dedicated short-range communication (DSRC) device for the frequency range from 2.4 to 5.8 GHz. It can also be appropriate to use a terminal for a cellular network (CN) or a data radio network as the communication device. Such a terminal is of advantage especially if it is suitable for digital mobile radio and corresponds, e.g., to the GSM standard. A terminal for the Mobitex system can also be advantageously used. In principle, it is also possible to use a communication device in which the information is transmitted via infrared or ultrasonic signals. However, optical transmission methods are less preferred due to their sensitivity to physical obstructions on the transmission path. It is also recommended to conduct the dialog between the control device and the toll apparatus of the respective motor vehicle in encrypted form. For this purpose, corresponding encryption and decryption components must be provided in the control device and in the motor vehicle or, respectively, the toll apparatus of the motor vehicle. This distinctly increases the security against manipulation. In the vehicle, the keys necessary for encryption can be stored, for example, in a chip card or a fixed memory of the toll apparatus or of the communication device used in the motor vehicle. A particularly effective protection against manipulation can also be guaranteed if, apart from the current charge and chip card

information, satellite, position and/or other apparatus information is interrogated and transmitted to the control device. If the roadside control device is equipped with a receiver for the signals of the navigation satellite system used, in a corresponding manner to the vehicle-mounted toll apparatus, the satellite signals currently received at the vehicle can be compared, for example, with the satellite signals currently received by the roadside control device. In this manner, confusions with other vehicles which are passing the roadside control device at the same time or very closely in time, and data manipulation can be virtually eliminated. This correspondingly also applies if the passing vehicle provides direct information on its current position at the time of the dialog.

Page 12, starting at line 12:

Figure 1 shows a block diagram of a control device according to the invention;

and

Page 12, starting at line 16:

The control device 1 shown in the form of function blocks in Figure 1 exhibits a communication device 2 which, for example, is constructed as a dedicated short-range communication device for a frequency in the region of 5.8 GHz. The control device 1 also comprises a classification device 3, the sensor system of which contains an electronic image sensor (e.g. in the form of an electronic camera). The control device 1 also has a trigger device 4 which is connected to the communication device 2 and the classification device 3 for signals. In addition, an evaluating device 5 and a recording device 7 are connected for signals to the trigger device 4. The evaluating device 5 consists, e.g., of an electronic computer which

performs a plausibility check with regard to the vehicle class of the vehicle currently being checked and passing the control device 1. For this purpose, this computer compares relevant information which is obtained from the checked vehicle or, respectively, from its toll apparatus via the communication device 2, with the corresponding information on the passing vehicle which has been determined by the control device itself in order to be able to specify the relevant vehicle class. If the evaluating device 5 finds that the vehicle class used in the toll apparatus in the vehicle is different from the vehicle class determined by the control device 1 itself, a signal is generated which is representative of the state that the vehicle currently passing is not performing a correct deduction of the road usage charges. A corresponding signal is then output via the trigger device 4 to the recording device 7 in order to make a recording which identifies the vehicle affected. This recording device 7 is constructed, for example, as an electronic camera. At the same time, this can advantageously also be used as sensor system for the classification device 3.

In the Abstract:

A roadside control device for checking the correct operation of a toll apparatus which is installed in a motor vehicle passing the control device and exhibiting an identifying license plate. The toll apparatus performs a satellite-supported electronic toll deduction and being equipped with the following facilities:

- a) a communication device,
- b) a classification device,

- c) a trigger device,
- d) an evaluating device, and
- e) a recording device.

Roadside control device for a toll apparatus installed in a  
motor vehicle

Description

The invention relates to a roadside control device for checking the correct operation of a toll apparatus which is installed in a motor vehicle passing the control device and exhibiting an identifying license plate, the toll apparatus performing a satellite-supported electronic toll deduction.

From EP 0 691 013 B1, the content of disclosure of which is included in the present application, an electronic deduction system is known by means of which utilization charges can be collected from vehicles which move through a predetermined geographic zone or a chargeable road distance (utilization charges = toll). The known system provides that in each motor vehicle, a toll apparatus is installed which has a receiver for the signals of a navigation satellite system such as, e.g., GPS (Global Positioning System) or Glosnar and is provided with an electronic memory in which the chargeable road distances and the geographic zones (in the text which follows, only chargeable roads or road distances are mentioned, to simplify matters) and the respectively associated utilization tariffs are listed. Using the signals of the navigation satellite system, the toll

apparatus has access to the current geographic position of the vehicle at any time and recognizes from the stored data concerning the chargeable road distances whether the motor vehicle is on a chargeable road distance or not and can automatically determine the toll amounts which may be due in this manner. To ensure completely anonymous deduction of the toll amounts, the known system provides for the use of debit cards (e.g. chip card) on which the respectively due toll amounts are deducted by the toll apparatus.

However, this method of collecting the toll amounts, which can be carried out with comparatively little expenditure, in principle opens up a number of possibilities for deception by the operator of the respective vehicle. Suitable precautions for detecting corresponding actions of misuse are therefore mandatory.

From EP 0 701 722 B1, a toll apparatus is known which exhibits for this purpose a device for self monitoring for unauthorized manipulations at the individual components of the toll apparatus and an error memory for recording diagnostic data in the case of an unauthorization manipulation. If an unauthorized manipulation occurs, the toll apparatus can send out a signal indicating the improper operation of the apparatus via a corresponding signal device.

Naturally, this presupposes that the apparatus itself is switched on and that the signal device has not been switched off or otherwise manipulated.



Furthermore, from EP 0 700 561, a toll apparatus is known which has a signal device via which diagnostic data which provide information on the operability of the toll apparatus or of its individual components, respectively, can be interrogated wirelessly from the outside. Using the transmitted diagnostic data, it should be possible to determine both non-payers and wrong payers who pay for their road utilization in a wrong class of charges. This document does not provide more detailed information on the external monitoring devices which are intended to determine and trace the road misuse.

From GB 2 295 476 A, a roadside control device for checking the correct operation of a toll apparatus which is installed in a motor vehicle passing the control device and exhibiting an identifying license plate is known, wherein the toll apparatus performs a satellite-supported electronic toll deduction. For this purpose, the control device exhibits a communication device for the wireless exchange of information between the control device and the toll apparatus in the passing vehicle. The toll apparatus is capable of determining toll amounts by means of time-dependent utilization tariffs and of deducting these amounts electronically from a credit value stored in an accompanying credit card. When a motor vehicle passes the control device, the facilities of the control device are activated by the triggering of a corresponding signal of an optical sensor. The communication

device of the control device transmits to the vehicle which is just passing a data inquiry which must be answered within a predetermined time. The response of the vehicle is then checked by the control device for the presence of an error code. An error code is stored by the toll apparatus if the enforcement light visible to the outside is damaged, if the credit value in the storage card becomes negative and if the antenna of the communication device has been shielded over a certain period of time and thus was not ready to receive. If no error code is detected, the control device assumes that the toll apparatus is working correctly. If, on the other hand, an error code is detected or no dialog can be established between the passing vehicle and the control device, a camera is activated which takes a photograph of the vehicle.

Finally, US 5 767 505 also discloses a roadside control device for operating a toll apparatus in motor vehicles which pass the control device. The toll apparatus performs a satellite-supported electronic toll deduction. In this process, single amounts are deducted whenever the vehicle has passed a virtual toll station, the position data of which are stored in the toll apparatus. In addition, the toll apparatus also has the position data of control stations and when these are being passed, it automatically transmits certain control data to a central station by means of digital mobile radio. Cameras installed at the control station record

all passing vehicles and their license plates and forward this information to the central station. At this station, the images are evaluated and compared with the control data in each case transmitted by the vehicle, the content of which data is not explained in greater detail. If there is no correlation between the data compared, then a report is generated in the central station in order to pursue the matter further manually. If there is correlation, then the data transmitted to the central station are deleted.

It is, therefore, the object of the present invention to specify a roadside control device for checking the correct operation of a toll apparatus for satellite-supported electronic toll deduction which, on the one hand, ensures a high success rate during the checks to be performed but, on the other hand, requires the least possible expenditure for the apparatus technology and the operation of the control device.

According to the invention, this object is achieved by a control device having the features specified in Claim 1. This control device can be advantageously developed further by means of the features of the dependent subclaims. An advantageous use of the control device according to the invention is specified in Claim 17.

According to the invention, the control device has at least the following facilities:

- a) a communication device for the wireless exchange of information between the control device and the toll apparatus in the passing vehicle,
- b) a classification device for allocating the passing vehicle to a predetermined vehicle class,
- c) a trigger device for the accurately timed activation of the devices of the control device,
- d) an evaluating device for a plausibility check of the data supplied by the communication device and the classification device from the and on the passing vehicle (or its toll apparatus, respectively), and
- e) a recording device for recording the license plate of the passing vehicle in the case of an unsuccessful exchange of information of the communication device with the toll device of the passing vehicle or in the case of a negative result of the plausibility check of the evaluating device.

The invention thus provides a control device which can handle the required roadside surveillance of the passing vehicle virtually automatically. Via the communication device, the control device can wirelessly request the toll apparatus of the vehicle passing in each case to transmit information on the current operating state of the toll apparatus.

In particular, such information contains details on the vehicle class used as a basis for the charge deduction and on the proper booking of the toll amounts, for instance on a debit card or alternatively via the correct transmission of the toll amounts to a charge deduction center. The communication device is preferably constructed as a dedicated short-range communication (DSRC) device for the frequency range from 2.4 to 5.8 GHz. It can also be appropriate to use a terminal for a cellular network (CN) or a data radio network as communication device. Such a terminal is of advantage especially if it is suitable for digital mobile radio and corresponds, e.g., to the GSM standard. A terminal for the Mobitex system can also be advantageously used. In principle, it is also possible to use a communication device in which the information is transmitted via infrared or ultrasonic signals. However, optical transmission methods are less preferred due to their sensitivity to physical obstructions on the transmission path. It is also recommended to conduct the dialog between the control device and the toll apparatus of the respective motor vehicle in encrypted form. For this purpose, corresponding encryption and decryption components must be provided in the control device and in the motor vehicle or, respectively, the toll apparatus of the motor vehicle. This distinctly increases the security against manipulation. In the vehicle, the keys necessary for encryption can be stored, for example, in a chip card or a

fixed memory of the toll apparatus or of the communication device used in the motor vehicle. A particularly effective protection against manipulation can also be guaranteed if, apart from the current charge and chip card information, satellite, position and/or other apparatus information is interrogated and transmitted to the control device. If the roadside control device is equipped with a receiver for the signals of the navigation satellite system used, in a corresponding manner to the vehicle-mounted toll apparatus, the satellite signals currently received at the vehicle can be compared, for example, with the satellite signals currently received by the roadside control device. In this manner, confusions with other vehicles which are passing the roadside control device at the same time or very closely in time, and data manipulation can be virtually eliminated. This correspondingly also applies if the passing vehicle provides direct information on its current position at the time of the dialog.

If necessary, information for police purposes which goes beyond the pure monthly deduction can also be transmitted from the vehicle (e.g. driving times of a lorry driver or vehicle data which could be read out via a CAN bus).

A particularly significant part of the roadside control device is the classification device which suitably also operates in accordance with an acoustic or optical

measuring principle. It has the task of recognizing the respective type of the passing vehicle by means of characteristic signals, with such an accuracy that it can be unambiguously allocated to a certain class of charges with the greatest reliability. With respect to acoustic measuring principles, the noises emitted by a motor vehicle can be analyzed, for example. Thus, a goods vehicle (truck or bus) has a distinctly different frequency spectrum from a passenger car or a motorcycle. From ultrasonic signals, for example, information can be derived which can be used for determining the size of a vehicle in order to be able to perform a class allocation in this manner. In general, a number of different measuring methods can also be combined with one another in order to increase the reliability of the allocation. In the context of the present invention, optical measuring methods are particularly preferred. In a preferred embodiment, the classification device therefore has a sensor arrangement which exhibits an electronic image sensor. This image sensor provides for the electronic recording of images of the respective vehicle which can then be compared with stored images from a vehicle class database. The allocation to a vehicle class is in each case performed in accordance with the greatest match in the image features. To reduce the computing effort for such a comparison method and to shorten the time required, it is particularly appropriate if the classification device operates in accordance with the

principle of optical correlation. In this case, it is not the image information but the spatial frequencies of the images which are optically superimposed and through which a light source is vertically shone. The intensity of the transmitter to light is a direct measure of the correlation of the images and thus of the class of vehicle. The vehicle class could also be determined by means of the heat distribution over the length of the vehicle, for example, with the aid of an infra-red image sensor, e.g. by means of a microbolometer array. Another alternative can be seen in the allocation of the vehicles passing the control device by means of a geometric vehicle surveillance by means of infra-red detectors. However, this type of vehicle classification is comparatively very complex and, as a rule, requires the installation of the control device on a bridge above the roadway to be observed.

The central component of the control device according to the invention is a trigger device which appropriately activates the various devices and components of the control device and also determines the time sequence of the vehicle classification. The trigger device detects the time at which a motor vehicle has reached a defined position on the roadway or a defined distance from the control device and, if necessary, also provides, e.g., additional information on the respective vehicle speed. The trigger device suitably has an electronic image sensor followed by image processing. As an alternative, a radar sensor or a laser sensor can also be



provided. Naturally, it is also possible to combine a number of different sensors.

The evaluating device has the task of determining whether the vehicle checked is legally driving on the road or not, i.e. whether the due road usage charges are correctly determined and deducted in accordance with the relevant tariff in each case by the toll apparatus in the vehicle. For this purpose, the information which is supplied, on the one hand, via the dialog with the toll apparatus and, on the other hand, by the classification device is compared and checked for plausibility. If the vehicle class interrogated from the toll apparatus of the motor vehicle, for example by radio via the communication device, deviates from the vehicle class determined by the classification device, the evaluating device supplies a signal which initiates further measures in order to pursue the probable violation of the law. Instead of a deceptive manipulation, a technical fault may also be present. The most important measure consists in securing evidence which provides for a reliable proof that the vehicle observed in each case has indisputably not performed a correct calculation and further debiting of the road usage charge due in each case.

For this purpose, a recording device is provided which produces, in the event of a negative result of the plausibility check or in the event that no dialog with the vehicle or, respectively, the toll apparatus of the vehicle

has been set up at all, a recording of the vehicle by means of which this vehicle can be unambiguously identified. Naturally, the recording of the license plate of the vehicle is primarily suitable for this purpose. Such a recording device can comprise, for example, an electronic camera. In this arrangement, it is also possible for the electronic camera of the recording device to be physically identical with an electronic camera which forms the sensor system of the classification device so that the expenditure for this component can be saved. The time at which the recording of the license plate is taken is predetermined by a corresponding signal by the trigger device.

It is particularly advantageous if the control device comprises a radio device, especially a data radio device, via which, in the case of an improper operation of the toll apparatus in the vehicle which has been detected by the evaluating device, the recording of the license plate of the vehicle affected and, as far as necessary, further data of the respective checking process can be transmitted to a control center. In this connection, it is also appropriate if the control device has a data compression device so that the data can be transmitted to the control center in compressed form. This makes it possible to distinctly reduce the capacity requirements for the transmission channels, and thus the costs of the data transmission.

Patented 2004-02-24

The control device according to the invention essentially consists of electronic components which require little constructional volume and have low energy consumption. This control device can, therefore, be produced as a compact equipment unit. It can be installed at fixed locations. e.g. on a mast used as equipment support, or on a bridge leading over the respective road. However, the installation in a vehicle is particularly advantageous with respect to the effectiveness of control processes which are carried out as spot checks, so that the control device can be used as a mobile device at any locations. This has the advantage, on the one hand, that a single apparatus can be used for serving a multiplicity of control points and that, on the other hand, the users of the chargeable road distances cannot adjust to control points known in advance in order to remain undetected as "fare dodgers", for example, by always performing a correct operation of the toll apparatus in time before reaching such control points while the toll apparatus is, for example, simply switched off otherwise. A particularly high level of flexibility in use and control effectiveness can be achieved if the control device is constructed in such a compact manner that it can be used as a hand apparatus (similar to a "radar gun" used for speed checking).

The present invention makes it possible to perform a check of the correct operation of satellite-supported toll apparatuses in spot-check or also continuous form with

comparatively low expenditure for the construction and operation of a roadside control device, in which arrangement a very high reliability with respect to the factual correctness of the control processes performed can be achieved. The essential factor is that the personnel expenditure necessary for this is extremely low since the control cycles occur virtually in fully automated form.

In the text which follows, the present invention will be explained in greater detail by way of an example with reference to the diagrammatic representations shown in the two figures, in which:

Figure 1 shows a block diagram of a control device according to the invention and

Figure 2 shows a diagrammatic representation of a control device installed by the roadside.

The control device 1 shown in the form of function blocks in Figure 1 exhibits a communication device 2 which, for example, is constructed as a dedicated short-range communication device for a frequency in the region of 5.8 GHz. The control device 1 also comprises a classification device 3, the sensor system of which contains an electronic image sensor (e.g. in the form of an electronic camera). The control device 1 also has a trigger device 4 which is connected to the communication device 2 and the classification device 3 for signals. In addition, an evaluating device 5 and a recording device 7 is connected for

signals to the trigger device. The evaluating device 5 consists, e.g., of an electronic computer which performs a plausibility check with regard to the vehicle class of the vehicle currently being checked and passing the control device. For this purpose, this computer compares relevant information which is obtained from the checked vehicle or, respectively, from its toll apparatus via the communication device 2, with the corresponding information on the passing vehicle which has been determined by the control device itself in order to be able to specify the relevant vehicle class. If the evaluating device 5 finds that the vehicle class used in the toll apparatus in the vehicle is different from the vehicle class determined by the control device 1 itself, a signal is generated which is representative of the state that the vehicle currently passing is not performing a correct deduction of the road usage charges. A corresponding signal is then output via the trigger devices 4 to the recording device 7 in order to make a recording which identifies the vehicle affected. This recording device 7 is constructed, for example, as an electronic camera. At the same time, this can advantageously also be used as sensor system for the classification device 3.

A GPS receiver 8, by means of which signals of the navigation satellite system used by the toll apparatus in the vehicle can be received, and a radio device 9 constructed, e.g., as a data radio device, by means of which the recording

made of the vehicle or, respectively, of its license plate, together with other information on the detected occurrence can be transmitted wirelessly to a control center, are appropriate, but not mandatorily required, for the operation of the control device 1 according to the invention. After the transmission, this control center then has reliable evidence on the basis of which the detected violation of the law by the driver of the respective vehicle can be pursued. The authenticity of the interrogated data can be completely guaranteed by means of the information of the GPS receiver 8 which can be compared with corresponding GPS information which is interrogated from the vehicle by the control device 1.

Figure 2 diagrammatically shows the process of a check by the control device 1. A motor vehicle 10 which is equipped with a toll apparatus 11 and carries a license plate 6 identifying the vehicle is driving on a chargeable road. Next to the road, the control device 1 according to the invention is set up on a mobile stand. The reference symbol 12 represents three satellites of a navigation satellite system which send out signals by means of which an accurate two-dimensional determination of the location of the respective GPS receiver, and thus of the vehicle position, is possible. The control device 1, which, naturally, could also be installed in a vehicle which is parked by the roadside, addresses the toll apparatus 11 by its dedicated short-range

communication device and interrogates the data required for determining the correctness of the operation of the toll apparatus 11. As soon as the control device 1 detects a motor vehicle 10 in which the plausibility check with regard to the correctness leads to a negative result, an evidence-securing recording of the vehicle 10, preferably of its license plate 6, is made via the recording unit, not shown in greater detail in Figure 2, and transmitted to a control center for pursuing the detected violation of the law, e.g. via a radio device not shown in greater detail in Figure 2. The relevant vehicle can then be pulled out of the traffic by the police at a suitable location (e.g. at a parking spot or a service area) and the relevant driver can be confronted with the evidence. At this location, it is then possible to determine whether the improper operation of the toll apparatus 11 is based on a manipulation or on a technical failure of the toll apparatus 11 which would not have to be defended by the driver of the vehicle 10.

Patent claims

1. A roadside control device (1) for checking the correct operation of a toll apparatus (11) which is installed in a motor vehicle (10) passing the control device (1) and exhibiting an identifying license plate (6), the toll apparatus (11) performing a satellite-supported electronic toll deduction and the control device being equipped with the following facilities:

- a communication device (2) for the wireless exchange of information between the control device (1) and the toll apparatus (11) in the passing vehicle (10),
- a trigger device (4) for the accurately timed activation of the devices (2, 3, 5, 7) of the control device (1),
- a recording device (7) for recording the passing vehicle (10),

characterized in that the following are also provided in the control device (11):

- a classification device (3) for allocating the passing vehicle (10) to a predetermined vehicle class,
- an evaluating device (5) for a plausibility check of the data supplied by the communication device (2) and the classification device (3) from the and on the passing vehicle (10), and
- a recording device (7) is set up for recording the license plate (6) of the passing vehicle (10) in the case of an unsuccessful exchange of information of the communication



device (2) with the toll apparatus (11) of the passing vehicle (10) or in the case of a negative result of the plausibility check of the evaluating device (5).

2. The control device (1) as claimed in claim 1, characterized in that the communication device (2) is constructed as a dedicated short-range communication (DSRC) device, especially as a radio device for the frequency range from 2.4 to 5.8 GHz.

3. The control device (1) as claimed in claim 1, characterized in that the communication device (2) is constructed as terminal for a cellular network (CN) or data radio network, especially in accordance with the GSM standard or for the Mobitex system.



1/1

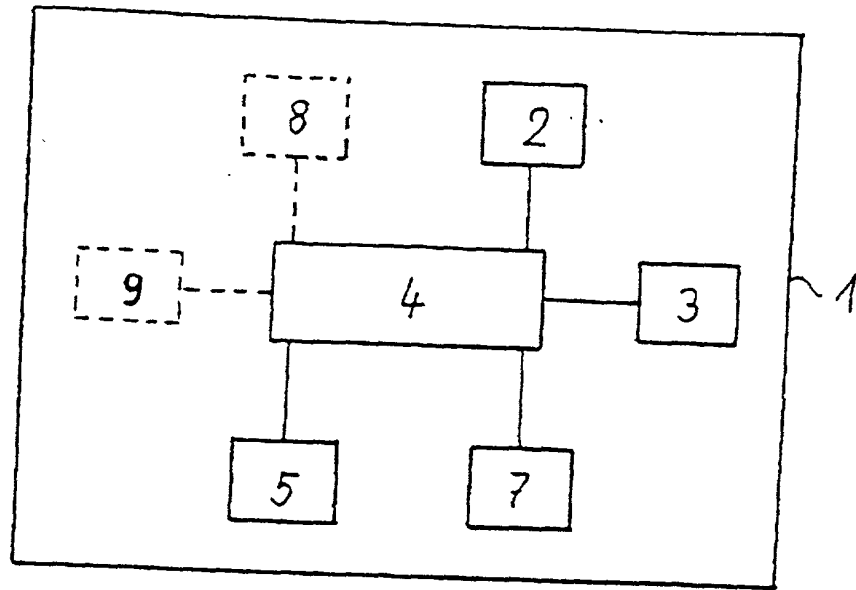


Fig. 1

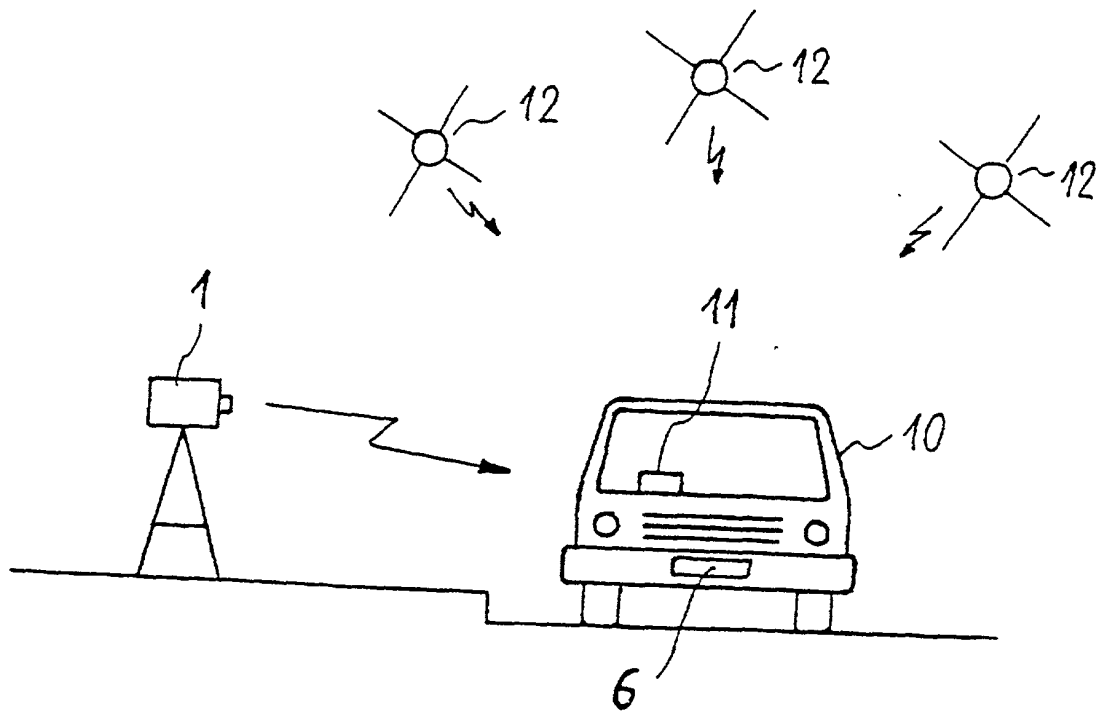


Fig. 2

Nov. 11 / 1914

[illegible]

Combined Declaration for Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications)				Attorney's Docket No. 3245-779PUS
2 0 3	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
<p>I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.</p>				
SIGNATURE OF INVENTOR 201 <i>W. de</i>		SIGNATURE OF INVENTOR 202 <i>Barber</i>		SIGNATURE OF INVENTOR 203
DATE x		DATE x 12-05-00		DATE

*Howat / Tag / Jahr**Howat / Tag / Jahr*

0308265108

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I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:					
PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:					
U.S. APPLICATIONS			STATUS (check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED	
PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			
PCT/DE99/01586	26 May 1999				
<b>POWER OF ATTORNEY:</b> As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (List name and registration number)					
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**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**  
Includes Reference to PCT International Applications

Attorney's Docket  
No. 3245-779PUS

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**ROADSIDE CONTROL DEVICE FOR A TOLL APPARATUS INSTALLED IN A MOTOR VEHICLE**

the specification of which (check only one item below)

☐ is attached hereto

☐ was filed as United States application

Serial No. \_

on \_

and was amended

on \_ (if applicable).

☒ was filed as PCT international application

Number PCT/DE99/01586

on 26 May 1999

and was amended under PCT Article 19

on \_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of the application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

**PRIOR FOREIGN/PCT APPLICATIONS AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:**

Country (if PCT, indicate "PCT")	Application Number	Date of Filing (day, month, year)	Priority Claimed Under 35 U.S.C. 119	
Germany	198 28 913.8	18 June 1998	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
PCT	PCT/DE99/01586	26 May 1999	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
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